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**OPERATOR'S MANUAL FOR THE  
10KR HIGH SPEED RAMPER  
WITH LOCAL CONTROLS  
AND HOME**

**PN: EDO102**



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## CHAPTER 1: INTRODUCTION

### SECTION 1-1 GENERAL DESCRIPTION

The 10KR high speed ramper provides a frequency-ramped pulse train to smoothly accelerate and decelerate a stepping motor drive system. It can be commanded by a remotely generated pulse train or by an on-card command generator. The 10KR also incorporates circuitry that, when used with external position sensors will command the motor to return to a fixed reference position (home). Total CMOS logic provides excellent noise immunity, and is compatible with TTL logic levels.

In the remote mode the 10KR will accept an input constant frequency pulse train up to 10 KC, and it will output a frequency-ramped pulse train that begins at an adjustable start/stop frequency. The frequency then increases, exponentially approaching the input frequency. When the input pulse train stops, the output pulse train frequency exponentially decays back to the start/stop frequency and stops. The number of pulses input will equal the number of pulses output. If another pulse train begins before the output pulse train ends, the output pulse train frequency will increase again without losing count of any pulses. Also in remote mode, a direction command (Hi = motor CW rotation) is passed through from the remote input to the output. It is not recommended that direction be changed while the output frequency is above the start/stop frequency.

In the local mode, the remote inputs are ignored, and an on-card pulse generator commands the system. The pulse generator consists of two parts; a single-step debounce latch that uses an SPDT switch for advancing the motor one step at a time, and an externally gated slew oscillator. The slew oscillator frequency can be adjusted from approximately 600 steps/sec to over 10,000 steps/sec. In local mode the remote direction input is also ignored, while the local direction input is passed through to the output.

## CHAPTER 2: SPECIFICATIONS

### A. MAXIMUM RATINGS

Power supply (+40)	25 to 45 V
Operating temperature	0 to 70 C ambient
Storage Temperature	-55 to +125 C
+5 V supply current avail.	50 mA

### B. MECHANICAL CHARACTERISTICS

Dimensions	6" x 7 1/2" x 11/16"
Mounting	6 3/4" x 5", 5 5/16" or 5 5/8" (1/8" re- quired below bottom board surface)

### C. ELECTRICAL CHARACTERISTICS

Logic input impedance	100 Kohms
M and M input impedance	10 Kohm (nominal)
Digital output current	- .12 mA (source) .36 mA (sink)
Clock out pulse width	5 uSec to 10 uSec
Local slew oscillator freq.	600 Hz to 10 KHz
Start/stop frequency	100 Hz to 3000 Hz
Accel/Decel time constant	25 mSec to 225 mSec
Max. output frequency	10 KHz
CZ delay	8 mSec to 27 mSec

## CHAPTER 3: INSTALLATION

### SECTION 3-1 I/O CONNECTIONS

#### A. J1 REMOTE INPUTS/OUTPUTS

- J1-1 +40V This line is connected to J3-1, and is for routing power to circuits attached to the remote input connector.
- J1-2 COM This is signal and power ground for the card.
- J1-3 CL This is the command pulse train input. The 10KR card recognizes the rising edges of command pulses. This input is only effective in remote mode.
- J1-4 DIR This is the direction input that is effective in remote mode. A high is understood to mean CW motor rotation when looking toward the faceplate of the motor.
- J1-5 Reset This input, when pulled low, terminates the home cycle, stops the output clock pulses, and causes J3-5 to go low.
- J1-6 Key
- J1-7 CZ This signal, called count zero, delayed, goes high approximately 15 mSec after the 10KR card outputs its last pulse. It signifies that the 10KR card has output the same number of pulses as it has been commanded. The delay is there to give time for the motor to settle into position. There is no delay, however, when this line goes low. It will go low within 5 uSec of an input clock command. This signal, on J3-7, commands the low current/high current command input of Aerotech chopper translators so that standby motor current is reduced from the running current level.

J2-5 Slew      When this signal goes low, an oscillator on the card is turned on. In local mode, the output of this oscillator becomes the input command pulse train.

J2-6 Spare      Not connected.

J2-7 Rem CL     This is a duplication of the remote clock input J1-3.

J2-8 At Home    This signal output goes high at the end of the home cycle when the motor has reached the home position. It goes low again when the first pulse is output after getting to the home position (this is only true when a marker pulse is present).

J2-9 CZ          This is a duplication of the output at J1-7.

J2-10 Spare     Not connected.

J2-11 Dir        This is the direction input that is effective in local mode. A high commands CW rotation. This input is disabled in remote mode.

J2-12 Step NO   This is meant to connect to the normally open terminal of an SPDT switch for single step commands. See J2-4, above.

J2-13 COM        This is signal and power ground for the 10KR card.

J2-14 +V         This is the logic operating voltage for the 10KR card.

J2-15 Spare     Not connected.

J3-8 Limit This pin is the input for the signal that goes out on J1-8.

J3-9 Current Feedback This signal is used to modulate the frequency slightly to prevent motor dropout.

J3-10 CCW Limit or uSW This pin is connected to J4-3 through jumper 19-20.

#### D. J4 HOME INTERFACE

J4-1 +V Operating voltage for 10KR.

J4-2 Signal and power ground for 10KR.

J4-3 CCW LMT The 10KR card is normally set up so that, at the start of the home cycle, the direction output goes low (CCW). Therefore, it is desired to change directions at the CCW limit of travel. This input will cause the home circuit to change directions when it goes low. The home circuit can be set up, however, to start the home cycle going CW (Dir High). If that is the case, then the CW limit instead of the CCW limit should be connected to this connector. Once direction is changed, further lows have no effect. If limit switch home is used, the motor changes directions when J4-3 goes low, and the home cycle is complete as soon as the limit switch returns high.

J4-4 Spare Not connected.

J4-5 and J4-6 Are M and M, respectively. These two signals constitute a differential pair that is fed to a comparator. When M is more positive than M, a "marker" is recognized. During the home cycle,

limit input at J4-3. The repeatability of the home reference will be determined by the repeatability of the limit switch closing and reopening. On Rev. M and above boards only, additional changes can be made to compensate for switches that are subject to a great degree of "switch bounce". These changes are as follows:

1. Remove 23-24, add 22-23.
2. Remove 0 ohm jumper at R59.
3. Add 150 Kohm, 1/4 watt resistor at R59.
4. Add IN914 diode at D10.
5. Add .47 uf capacitor at C24.

#### **D. M LOADING (PADS 9 AND 10)**

Some shaft position sensors (encoders) have NPN open emitter outputs and are designed to operate into a resistance to ground. Other sensors can operate into the wiper of a balance pot between ground and +V. If an NPN open emitter type of sensor is used, the jumper between pads 9 and 10 should be removed.

#### **E. +V OPERATING VOLTAGE (PADS 11 AND 12)**

For +12V operation, remove the jumper between pads 11 and 12. For +5V operation, connect jumper between pads 11 and 12. If the board is Rev. M or above, +12V operation is enabled by removing the 0 ohm jumper at R19; +5V operation, which is standard, is enabled by adding a 0 ohm jumper at R19.

#### **F. J2-1 DEDICATION (PADS 14, 15 AND 16)**

J2-1 is normally connected to J1-8 (Limit). To simplify wiring in some systems it can be patched to J1-4 (Remote direction). To do this, remove jumper between pads 14 and 15 and insert a jumper between pads 14 and 16.



## CHAPTER 4: ADJUSTMENTS,

### SECTION 4-1 VARIABLE RESISTORS (POTS)

#### A. SLEW SPEED (R8)

In local mode the frequency of the command pulse train is adjusted at R8. CW rotation increases the frequency.

#### B. MARKER BALANCE (R22)

The difference between the M and M signals determines whether a marker pulse is recognized. What that difference needs to be can be set by R22. CCW rotation increases the level needed at the M input to recognize a marker.

Be sure the R22 is not turned full CW.

#### C. ACCEL/DECEL (R29)

The exponential rise and exponential fall of frequency have the same time constant. This time constant is set at R29.

CW rotation shortens the time constant.

#### D. START/STOP (R34)

The frequency at the start of the ramp up and at the end of the ramp down is the start/stop frequency. It is also the frequency during a home cycle. The frequency can be adjusted at R34.

CW rotation increases frequency.

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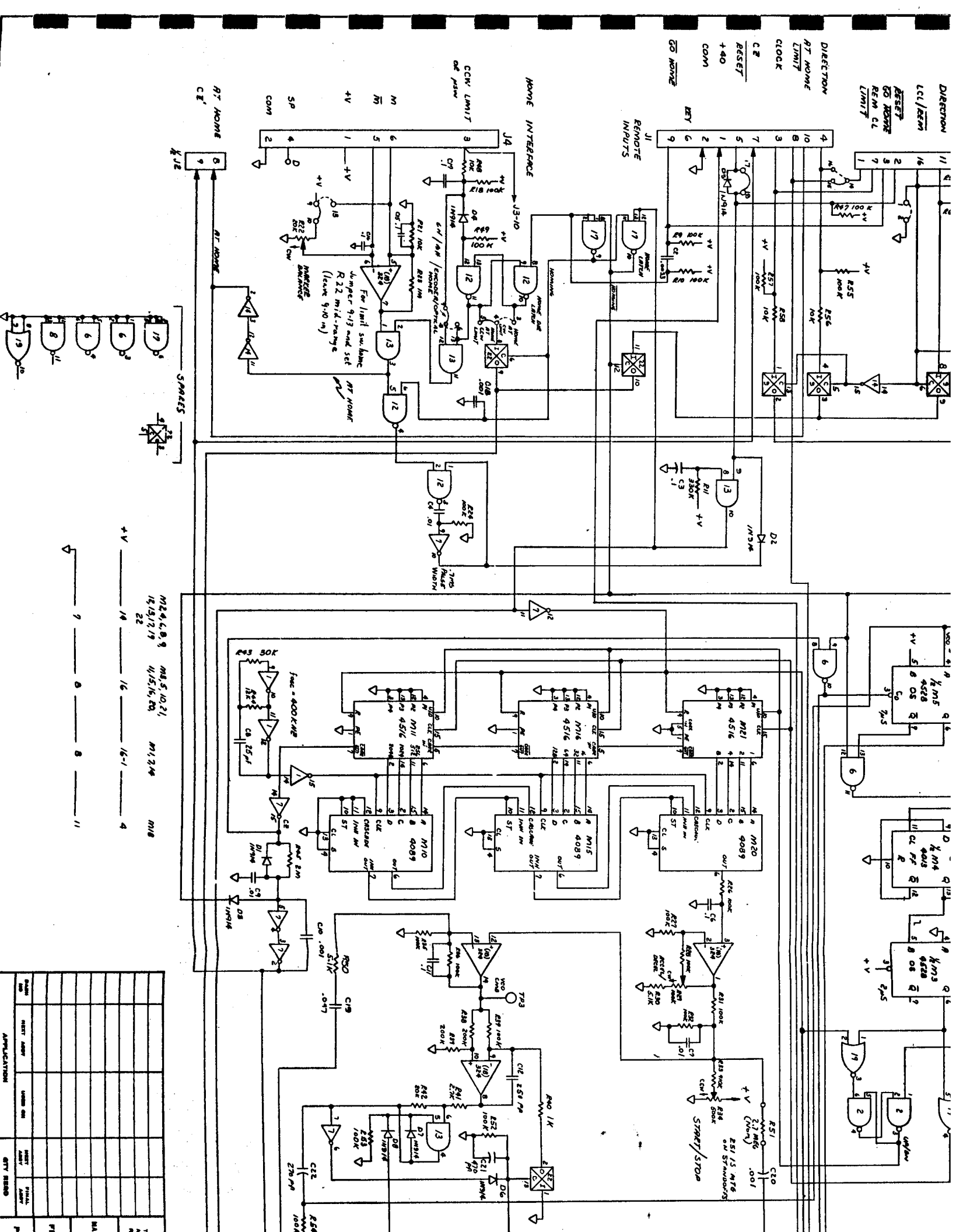
Mechanical characteristics, 2-1

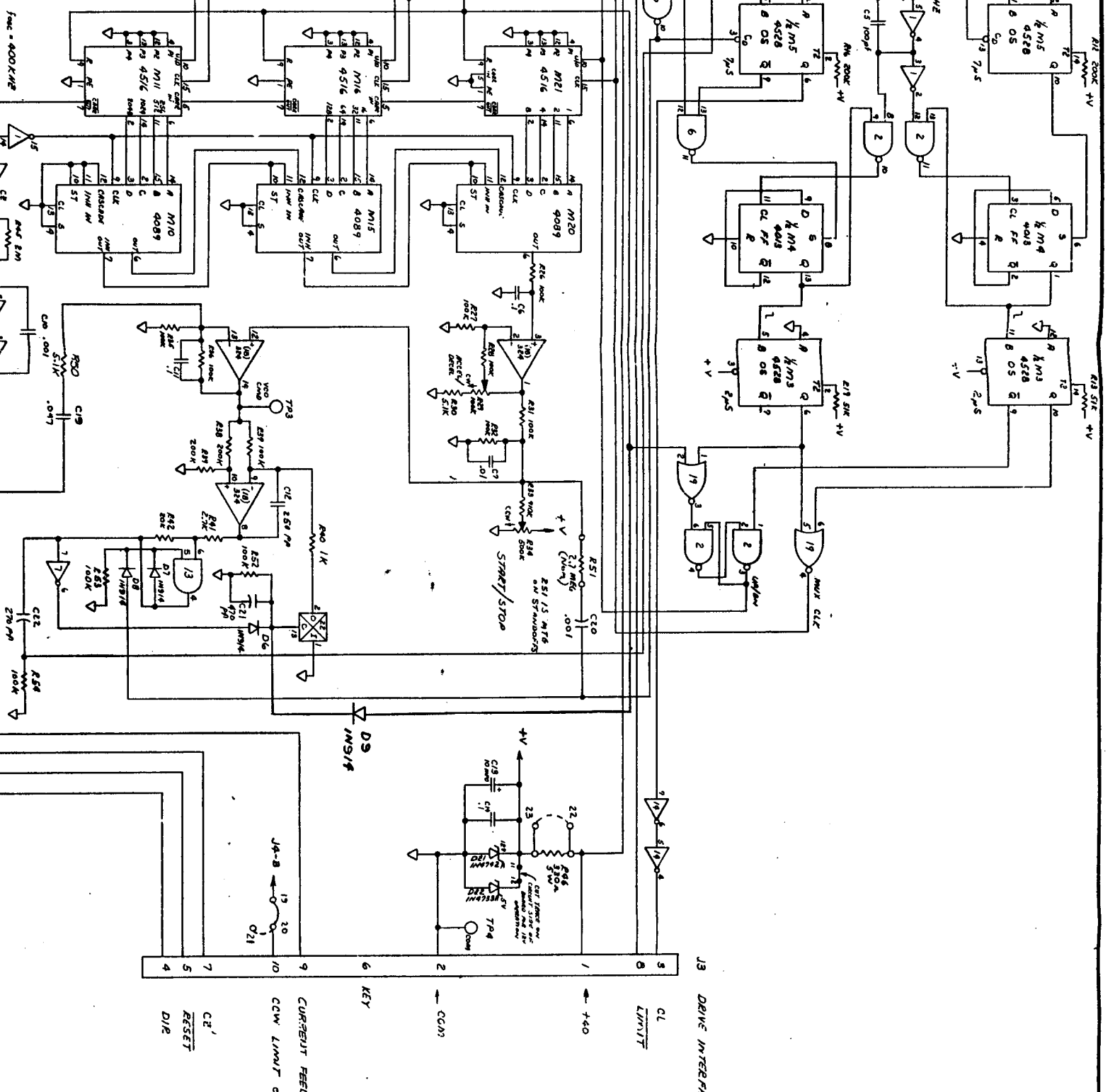
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- INDICATES WHERE TRACE CAN BE CUT
- INDICATES STANDARD NUMBER
- INDICATES E.S. OR OPTIONAL NUMBER
- LAST E.S. = ESB
- LAST M = M128
- LAST C = C22

M1, 7, 18 = 9089, M2, 5, 12 = 9011, M3, 11, 20, M10, M12 = 90M

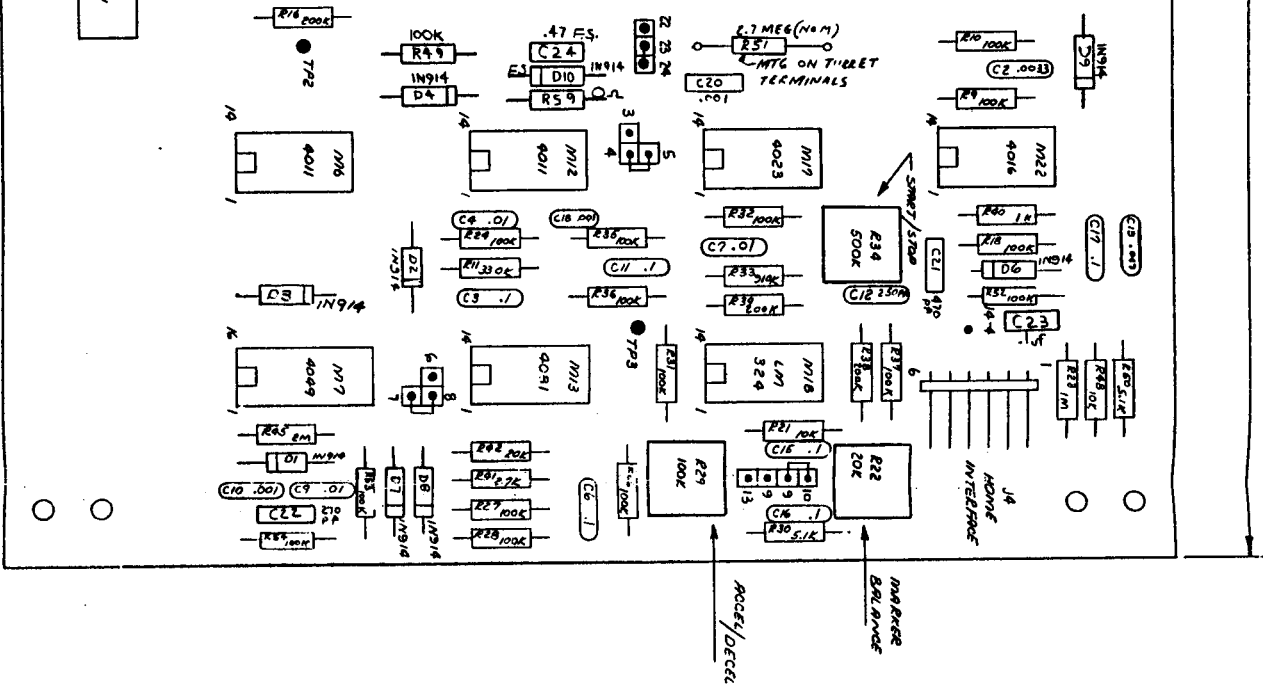
**DRIVE INTERFACE**

- 1 - CL
- 2 - +40
- 3 - D3
- 4 - KEY
- 5 - CURRENT FEEDBACK
- 6 - CURRENT LIMIT OR JASM
- 7 - CE'
- 8 - RESET
- 9 - D12

**REVISIONS**

REV	DATE	DESCRIPTION
A	11/15/64	PER ECN 0083, 0085, 1, 0092
B	1/14/65	PER ECN 0093
C	7/24/65	114/15 NETWORK ERROR
D	11/1/65	DESIGNS GATE 145 (SMALL DISTANCE) DATE 5/20 OR M12. M102, M103, M104, M105, M106, M107, M108, M109, M110, M111, M112, M113, M114, M115, M116, M117, M118, M119, M120, M121, M122, M123, M124, M125, M126, M127, M128, M129, M130, M131, M132, M133, M134, M135, M136, M137, M138, M139, M140, M141, M142, M143, M144, M145, M146, M147, M148, M149, M150, M151, M152, M153, M154, M155, M156, M157, M158, M159, M160, M161, M162, M163, M164, M165, M166, M167, M168, M169, M170, M171, M172, M173, M174, M175, M176, M177, M178, M179, M180, M181, M182, M183, M184, M185, M186, M187, M188, M189, M190, M191, M192, M193, M194, M195, M196, M197, M198, M199, M200, M201, M202, M203, M204, M205, M206, M207, M208, M209, M210, M211, M212, M213, M214, M215, M216, M217, M218, M219, M220, M221, M222, M223, M224, M225, M226, M227, M228, M229, M230, M231, M232, M233, M234, M235, M236, M237, M238, M239, M240, M241, M242, M243, M244, M245, M246, M247, M248, M249, M250, M251, M252, M253, M254, M255, M256, M257, M258, M259, M260, M261, M262, M263, M264, M265, M266, M267, 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**11 REVIDTE INPUTS**

- 1 +40
- 2 COM
- 3 CLOCK
- 4 DIRECTION
- 5 RESET
- 6 KEY
- 7 CR
- 8 LIMIT
- 9 GO HOME
- 10 AT HOME

**12 FRONT PANEL INTERFERENCE**

- 1 RESET
- 2 GO HOME
- 3 STEP NC
- 4 STEW
- 5 SPARE
- 6 SPARE
- 7 AT HOME
- 8 AT HOME
- 9 CR
- 10 SPARE
- 11 DIRECTION
- 12 STEP NO
- 13 GND
- 14 +V
- 15 SPARE
- 16 LCL / RETN

**13 DRIVE INTERFERENCE**

- 1 +40 (INPUT)
- 2 COM
- 3 CLOCK
- 4 DIRECTION
- 5 RESET
- 6 KEY
- 7 CR
- 8 LIMIT
- 9 CURRENT FEEDBACK
- 10 CCW LIMIT OR A SW

**14 HOME INTERFERENCE**

- 1 +V
- 2 COM
- 3 CCW LIMIT OF A SW
- 4 SPARE
- 5 M
- 6 M

**STANDARD JUMPERS**

FROM	TO
4	5
7	8
9	10
14	15
19	20
25	26
1	2
23	24

**REVISIONS**

REV	DATE	REVISIONS	DATE	APPROVAL
A	1/4/71	REV ECN 0083, 0084, 0092	1/4/71	1/7/71
B	1/17/71	REV ECN 0093	1/17/71	1/17/71
C	2/11/71	1/1/71 REWORK INCREASED CLEARANCE	2/11/71	2/11/71
D	2/11/71	ORRATED 219, 20, 138, 24, 211, 2007	2/11/71	2/11/71
E	2/11/71	ADDED 13-10 TO 14-8, AND 028	2/11/71	2/11/71
F	2/11/71	REV ECN 0159 AND 0158	2/11/71	2/11/71
G	2/11/71	ADDED D4 & R49 ECN 0167	2/11/71	2/11/71
H	2/11/71	NO CHANGE THIS SHEET	2/11/71	2/11/71
J	2/11/71	ADDED C19 & R50 ECN 0169	2/11/71	2/11/71
K	2/11/71	ADDED D5, P15-17, 18, R40, R41, R42	2/11/71	2/11/71
L	2/11/71	ADDED C20, C21, C22, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, K1, K2, K3, K4, K5, K6, K7, K8, K9, K10, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, M1, M2, M3, M4, M5, M6, M7, M8, M9, M10	2/11/71	2/11/71
M	2/11/71	ECN 0471, ECN 0472, ECN 0473, ECN 0474, ECN 0475, ECN 0476, ECN 0477, ECN 0478, ECN 0479, ECN 0480, ECN 0481, ECN 0482, ECN 0483, ECN 0484, ECN 0485, ECN 0486, ECN 0487, ECN 0488, ECN 0489, ECN 0490, ECN 0491, ECN 0492, ECN 0493, ECN 0494, ECN 0495, ECN 0496, ECN 0497, ECN 0498, ECN 0499, ECN 0500	2/11/71	2/11/71